HEAVY WEATHER ADDENDUM

Overview

Introduction

This Addendum provides a general overview of boat operations in heavy weather. Heavy weather poses a particular threat to the boat and the safety of its crew. Boats are not to be operated beyond their operating limits and crew should not undertake operations beyond their capabilities. Proper risk management is essential. All boats can be expected to encounter heavy weather but that does not mean specific operational evolutions must be undertaken. The boat crew must heed the guidance and warnings contained within this addendum. Surf operations are conducted only by surf-capable boats and specially trained crew.

In this addendum

These items are discussed in this addendum:

Section A. Heavy Weather Wave And Surf Characteristics

Introduction

A thorough understanding of surf and wave action is essential for a boat crew to safely operate in a heavy weather/surf environment. Crews for Coast Guard motor lifeboats (MLB) and surf rescue boats (SRB) received special training for heavy weather operations. The other Coast Guard boats have operating limits that do not allow operations in surf. While theory and formulas may be of little use when you are faced with a series of 12 to 14 foot breakers, knowledge of how waves are formed and behave at sea, over shoals, and in the surf zone will equip a coxswain to make the best possible decisions and minimize danger to the crew and boat. There are we no such things as “sneaker” waves, only waves for which we have not prepared.

The combination of wave and surf factors can cause interference with an infinite number of possibilities, and coupled with the effects of currents, wind, and geographic factors, can create situations where no vessel or crew can operate safely. In heavy weather, awareness is the key to running the safest operations possible.

General wave and surf characteristics can be found in Chapter 12, Weather and Oceanography. This section covers only heavy weather wave and surf characteristics.

In this section

This section contains the following information.

Waves in Heavy Weather

A.1. Formation of ocean waves

There are several forces which create waves at sea, the most significant of which is wind. The factors which determine the characteristics of wind waves are:

- wind speed,
- wind duration, and
- fetch (the distance over open water which the wind has blown).

As the wind begins to blow, it creates seas, which are typically steep, choppy, and have little pattern. As the wind continues, the seas begin to become more defined. In heavy weather, observing and measuring waves is important; if you can get a general sense of the waves in which you are operating, it will allow you and your crew to operate accordingly.

A.2. Effects of wind

Strong winds usually have the same effects as strong currents on wave behavior, but because of the infinite variables of wind speed, direction, and interaction with currents, it is often difficult to predict what effect the wind will have on waves.

Observing and Measuring Waves

A.3. General

The ability to recognize wave patterns and characteristics is essential to safe operation in surf and heavy weather. A coxswain operating in these conditions must be able to determine the timing of lulls and series, and estimate wave heights accurately.

A.4. Timing

The lull period in a wave system is the safest time to transit a bar, inlet, or shoal area in heavy seas/surf. By timing the duration of the lull, we can be prepared to make a transit while the waves are smaller and we will also have some idea of how much time is available before the next big set rolls through. The basic technique is to use a stopwatch. After the last big wave of a series has passed, the time is started. When the first big waves of the next set arrive the time is stopped. This is the duration of the lull, which may range from less than a minute to several minutes. This pattern should be observed for as long as possible until you arrive at a useful consistent time. You may also find it useful to time the duration of the series and number of waves in the set. There may be circumstances where the time is not consistent nor does the mission allow time to wait. In these circumstances, you may have to simply identify the beginning of the lull and make your move with the knowledge that another set could arrive at any time.

A.5. Estimating wave height

An accurate estimate of wave height is subjective and sometimes difficult to accomplish, but there are a number of methods that, with practice, will give good results.

A.5.a. Height of eye or freeboard

With the boat in the trough and on a level and even keel, any wave that obscures the horizon is greater than your height of eye. The height of eye on a 44' MLB is about nine feet while seated at the helm or standing on the flat. One can also compare a wave to the deck edge or a structure such as the handrail. Observe the wave face while you are bow into it and in the trough on an even keel. This is also generally the best method for judging surf.

A.5.b. Comparison with floating structures or vessels	This technique is most useful when observing from land, but may be applied while underway. If you know that the freeboard of a buoy is 13 feet, you can use that information to determine the height of the waves passing it. A buoy can also be used to determine the wave period. One can observe a vessel underway and by estimating the freeboard of the vessel and observing its motions on the water, you can gain a fair estimate of the seas in which it is operating.
A.5.c. Comparison with fixed structure	Observation of waves as they pass a fixed structure, such as a breakwall, jetty, or pier, can be very accurate and can also provide wave period.
A.5.d. Depth sounder	This method can be very accurate. A “flasher” type depth sounder works best, but a digital finder with a fast update speed will also work. By comparing the depth in the trough on even keel with the depth at the crest on even keel, you can arrive at an accurate measurement. All of these methods can be useful and reasonably accurate, but they require practice and experience, By comparing a local Weather Service buoy report with your observations, you can fine-tune your sense of wave height. With enough practice, you should be able to judge wave heights simply by looking at the waves themselves.

Surf Zone

A.6. Types of surf

There are three basic types of breaking waves:

- plunging,
- spilling, and
- surging,

Each of which is discussed in Chapter 12, Weather and Oceanography. Each type of breaking waves brings its own hazards, such as suction currents, dropping huge quantities of water, and exerting a great deal of force. It is important to remember that, when operating in heavy weather, these hazards are often magnified beyond calm water operations.

A.7. Surf zone characteristics

In normal operations and especially in heavy weather, there are a number of conditions created in the surf zone and in individual waves of which the coxswain must be aware. These include the following paragraphs.

A.7.a. Windows

A window is an area where the waves have momentarily stopped breaking, opening up a safer area of operation for your boat. Windows often form in the area of aerated water where a large set of waves has just finished breaking, The window may remain for a long time or may begin breaking again almost immediately. It is preferable to operate the boat in the windows whenever possible.

A.7.b. High/low side of a wave

The “high side” is defined as the section of a wave which carries the most potential energy. It may be the part that is still building towards breaking point, or it may be the part which has already broken. The “low side” is where the least potential energy exists and represents the safest direction to turn while running stern-to. These high and low sides often change rapidly, and the ability to quickly navigate the high and low sides is a critical skill for surf operations.

A.7.c. Wave saddles

The “saddle” is the lowest part of a wave, bordered on both sides by higher ones. Often it is a small, unbroken section of a wave that is breaking. It is preferable to drive a boat in the saddles if possible, thus avoiding the whitewater. While saddles are very useful, they must be watched carefully, because they easily turn into “close-outs.”

A.7.d. Closeouts	"Closeouts" occur when a wave breaks from the ends toward the middle, or two waves break towards each other. The middle may look like a good saddle, but can quickly turn into whitewater. Closeouts should be avoided because they can create more energy than a single break.
A.7.e. Wave shoulder	The "shoulder" is the edge of a wave. It may be the very edge of the whitewater on a breaker, or the edge of a high peaking wave that is about to break. The shoulder is usually lower in height than the middle of the wave. Driving on the shoulders can be particularly useful in a narrow surf zone because it allows you to drive very close to a break in relative safety.
A.7.f. Rip currents	Rips are created along a long beach or reef surf zone. The water from waves hitting the beach travels out to the sides and parallel to the shore line, creating a "longshore current" that eventually returns to sea. This seaward flow creates deep channels in the sand offshore that can shift from day to day. In the case of a reef, the channels are permanent parts of the reef, but otherwise behave the same. In these channels, the waves or surf are usually smaller because of refraction over the deeper water. Because of this, a rip channel often represents a safer route into or out of a surf zone. A rip current may also carry a person in the water or a disabled vessel clear of the surf zone. If using a rip current, take great care to stay in the channel by watching the depth sounder. Be alert for debris, which tends to concentrate in these areas.

Section B. Heavy Weather Boat Handling

Introduction

In calm weather, there is no difference between handling a boat under power at sea or anywhere else, except that there is a lot more room. If there are waves of any size, you must understand the effects they will have on your boat and crew.

The discomfort that can be experienced when underway on boats in heavy seas is hard to describe to those who have not experienced them before. It can drain a person of all their energy and willpower at the times that they are needed most. It can hamper the capacity for a person to make a rational and prudent decision in tough situations.

In this section

This section contains the following information.

Motions

B.1. General

There are three basic motions that a boat experiences while operating in a seaway. They are rolling, pitching, and yawing. Each motion creates its own problems.

B.2. Wave generation

Before we can discuss the effects weather has on boats, you must understand that waves are generated by winds. As the wind is never regular, neither are the waves. A normal seaway may consist of different trains of waves, running in slightly different directions and heights. When waves coincide with each other, they can produce one wave as high as the sum of all their heights. Also, when troughs coincide, they can produce a trough with combined depths of all of them, or a trough combining with a wave producing a flat patch. Most of the time, waves vary a bit in height and direction, but now and then a big wave comes along, or a flat patch, or a deep hole in the water. All of these factors, alone or combined, play a part in how a boat reacts and moves in the water.

B.2.a. Rolling

Rolling is caused by a wave lifting up one side of the boat, rolling under the boat and dropping that side, then lifting the other side and dropping it in turn. The next wave then approaches the boat and goes through the same scenario. This action is due to the boat running beam to the swell The moment the boat starts rolling, it automatically rolls back and forth in accordance with the time of its natural roll period. This will cause the boat to sometimes roll against the next wave, sometimes with it, but usually altogether out of step with the arrival of the waves.

B.2.b. Pitching

Pitching occurs when the boat is running bow into the waves. Each wave first lifts up the bow, passes underneath and drops the bow, then lifts up the stern, passes underneath and drops it. Although not as dangerous as rolling, violent pitching in close steep seas can put great stress on both your boat and your crew. In suitable conditions, synchronous pitching can occur in the same manner as synchronous rolling, and the result is an increasingly violent and regular motion.

B.2.c. Yawing

Yawing is caused when the boat is operating in a following sea. The wave approaches the stern of the boat, lifts it up, drops it, and travels forward, lifting the bow and dropping it in turn. In theory, this action is similar to pitching, but in reverse and usually much gentler because the boat is motoring away from, instead of into, the waves. As the wave lifts up the stern, the bow of the boat begins to be pushed forward through the water, causing a resistance against the boat's hull. With the combination of resistance and the speed of the wave, the stern tries to overtake the bow, causing it to broach. Once the wave clears the stern, it lifts the bow of the boat and the stern begins to slide down the backside of the wave, pulling the bow back around and causing the boat to straighten back out.

Control of Effects

B.3. General

Now that you have an understanding of what effects swells have on your boat, you need to know what corrective measures can be taken to decrease the effects.

B.4. Altering course and speed

Dangerous rolling is proceeded by discomfort, or at least a small period of concern. As explained before, rolling is caused when running beam to the seas or slightly quartered off the seas. To correct, alter your course. This interrupts the frequency of the period of contact with the beam seas. If you just slow down in this situation, there will be no difference in the motion of your boat because the speed has no bearing on the frequency of beam seas. When quartering the seas, you may also experience the rolling motion. If you are experiencing a great deal of rolling while quartering, your best course of action is to slow down, again interrupting frequency period. With the combination of altering course and speed, you and your crew should have a more comfortable ride.

B.5. Pitching

Severe pitching will fatigue or injure your crew long before it damages your boat, and is the least dangerous in heavy weather. Violent pitching can be corrected in the same manner as correcting rolling: alter course and/or speed, interrupting frequency of period of wave encounter. In heavy weather, watch for the possibility of very deep troughs so that the boat can be immediately slowed to reduce the impact as the boat falls into it.

B.6. Yawing

Running stern-to in heavy seas requires intense concentration, as steering corrections must be made the instant you feel the stern of the boat being lifted by the oncoming swell. If you are traveling too fast and not paying attention, the wave will lift up the stern and broach the boat one direction or the other. You may not be able to correct if the wave gets a hold of the boat and begins to surf it. Once the wave has control of your boat, you are at the mercy of whatever it wants to do to you, such as roll, pitchpole, or striking a floating object. You will have no control; therefore, pay attention so you can apply corrective measures soon enough to prevent any disasters. To keep from yawing, realize that the wave is approaching your stern. If the wave approaching is a large steep wave and the

possibility of surfing is great, slow down before the wave gets to you and allow it to pass underneath you. After the wave passes underneath the boat, increase your power to the original RPM. If you are operating in fairly regular seas, steer the boat as you normally would, turn in the direction towards which the stern tends to slip. No increase or decrease in power will be necessary as long as the swells are not big enough to cause your boat to surf. If you find yourself being lifted up and surfed, increase your power. As the bow begins to dig into the trough and veer to one direction, keep power on and turn the helm hard in that direction. This action will cause your boat to dig itself out of the wave and climb up over the top. Another method is to do an "S" turn. The "S" turn is a very effective and safe maneuver as long as it is done in time and done correctly. It is the most often used maneuver.

B.7. Wind

Wind effects the boat AND the swell. It requires just as much attention and concern. No matter what operational function you are conducting, e.g., man overboard, towing, or just swimming, you need to be aware of the wind. As wind increases, so do the seas, and with the combination of both, the boat is more and more difficult to handle. The slower the boat travels, the more effect the wind has, and the harder it is to maneuver. If the boat is dead in the water (DIW), the wind will push against any sail areas, causing the boat to turn in the direction in which the wind is blowing. The harder the wind is blowing, the faster it turns, and the harder it is to counteract. This action plays an important part in boat handling, especially if you're operating in close quarters, making a towing approach, or trying to just keep station.

B.7.a. Counteract the wind

To counteract the wind and/or seas, pivot the boat in against the wind. Don't be afraid to use the power available to you; sometimes all it takes is very small amounts of throttle, using one engine at a time. Other times it might take massive amounts of power using both throttles together. There is not just one way of using your power; it all depends on the amount of wind blowing against you. If you are running into the wind, depending on amount of the boat's sail area is in contact with the wind, the boat will travel slower because of the resistance. There is no real corrective action for this, but coxswains need to be aware of it. In the same manner, if you are running with the wind on your stern, and depending on amount of sail area, your speed will increase. As long as the coxswains and their crews are aware of their surroundings and what is going on with their boat, all corrective actions will be able to be made in ample time.

Experience

B.8. General

As a coxswain in the Coast Guard, you have been entrusted with the safe operation of the boat and the safety of the crew. To accomplish this, you must have a complete grasp of boat handling in different situations and environments. This chapter will give you a basic understanding, but by no means will it give you a complete knowledge of how boats handle in different conditions. That knowledge will come with experience.

B.9. Boat reaction

Boat handling in heavy weather is similar to boat handling in calm weather. Although the maneuvers are the same, because of conditions you are in, you will have to use more power, requiring greater concentration and alertness from both coxswain and crew.

B.10. Preparations

Before the boat even gets underway, there are a number of items that need to be checked. For instance:

- Check your boat to ensure that all the equipment is on board, in good condition, and fully operational.
- Ensure that all electronics have been tested and are completely functional.
- Check throttles and steering to ensure that they are fully operational.
- Look at your crew to ensure that they are qualified and certified and that they have all of their survival equipment. Check the weather and bar conditions.
- Most important, know what your mission is.

Boat Handling

B.11. General

The following will be the same procedures used in a heavy weather environment. A coxswain needs to be very familiar and confident in applying these fundamentals.

B.12. Station keeping

Station keeping is one of the hardest and most often used fundamentals used in boat operations, such as hooking up a tow, person in the water (PIW) recovery, personnel transfers, and surf operations. Before you can station keep, you need to be familiar with your conditions. For example:

- How hard is the wind blowing, and from what directions?
- What is the swell direction?
- What direction are the sea and current from?

It is very important that all of these factors are considered; each will have a separate but equally important effect on the boat. The objective of station keeping is to be able to hold your bow square into the most predominant force while keeping your boat in one position. Normally the swell will be your predominant force, though depending on your area and different circumstances, the wind and sea may be more predominant. For the purpose of this chapter, the swell will be considered the predominant force. If the wind and seas are not from the same direction as the swell, they will push against the sail areas of the boat, forcing the bow to fall off the swell to either port or starboard side. The coxswain needs to be aware that this is happening and begin corrective measures. The power of the force against you needs to be counteracted with the same amount of force. The coxswain will need to use both the rudders and throttles in conjunction with each other. Again, sometimes it only takes a little power, and other times it may take a lot of power. Use whatever force is necessary to keep your bow from falling off the swell and keep your boat in one position. If the wind is pushing you on the port side, push back by pivoting the boat port and using your wheel to port, applying enough power to accomplish the results you want. Drive the boat, don’t let the boat drive you!

B.13. Backing

NOTE

If you leave your rudder locked over in one direction while backing and pull your power off, the boat's rudders will take over and you will swing in that direction very dramatically. Rudders need constant propeller force in order to prevent this from happening. When completed backing, immediately shift your rudder amidships and apply forward propulsion.

Backing your boat in a straight line is very important and very difficult. Most coxswains cannot back the boat any distance without allowing the bow to fall off the swell. Backing is used in the same situations as station keeping and all boat drivers need to be proficient in it. Before you can start backing, get your bow square to the swell, engage both throttles in reverse, put your helm to amidships and start applying small amount of power with a gradual increase of power. As the boat begins to back, the bow will start to fall off to one direction or the other, depending on wind. As the bow slips to whichever side, begin to counter with more throttle control and rudder. *For example*: if the bow slips to port, counter by shifting your rudder to port, increase starboard reverse power and decrease port reverse power. While doing this, you will observe the bow begin to straighten up to starboard. As it does, correct your rudder back to amidships and bring your throttles back to an even RPM. This process continues throughout the entire evolution. Keep countering with rudder and throttles until you have backed to desired position. If your bow falls off too far before you begin to counter, you will not be able to correct by backing without subjecting your boat and crew to a very uncomfortable ride. If not corrected soon enough, the boat will fall completely to beam seas. When this happens, your best corrective action is to use what ever power is necessary to get your bow back square into the swell, then begin backing again. You should never back on the face of a large swell; if done incorrectly, the swell may take complete control of your boat. The swell action will amplify the amount of degree the bow fell off, thus making it very difficult, almost impossible, to correct.

If you keep your bow square to the swell of most predominant force and use proper amounts of power for different situations, the boats can be handled without a lot of difficulty. It takes many hours of training and practice to become proficient and effective.

Section C. Heavy Weather Piloting

Introduction

The distinction between "piloting" and "navigation" is outlined in many respected publications, including Dutton's *Navigation and Piloting* and Bowditch's *Practical Navigator*. This chapter is designed to offer techniques that are unique to operations in heavy weather situations.

The importance of sound piloting is well described in Dutton's:

> "Piloting requires the greatest experience and nicest judgment of any form of navigation. Constant vigilance, unfailing mental alertness, and a thorough knowledge of the principles involved are essential … In pilot waters there is little or no opportunity to correct errors. Even a slight blunder may result in disaster, perhaps involving the loss of life."

Some might consider this statement melodramatic, yet in essence, it is true. Any situation that might be stressful or confusing will be compounded when the dimension of heavy weather is incorporated. The loss of life may not involve your crew, but if you are unable to pilot a vessel to persons in distress, it most certainly will involve the lives of mariners who entrust their lives in the abilities of boat operators to come to their assistance.

In this section

This section contains the following information.

Preparation

C.1. General

Being prepared is not limited to having the proper or sufficient equipment aboard. Preparation for a heavy weather case involving piloting (which all must if you leave the dock) can begin months before the mission. The primary tool to ensure success in any piloting evolution is local knowledge. The ability to quickly match objects seen visually or on radar with charted objects will increase a coxswain's capabilities. Naturally, calm weather affords the best situation to study your area underway, but observing your AOR during heavy weather from land or sea will enable you to identify hazardous areas particular to inclement weather. Of course, none of the tools available are useful if you are not well versed in how to use them. No amount of studying or classroom instruction can substitute for underway training. You should take every opportunity to pilot, no matter what the conditions may be. The wise coxswain "over-navigates" the boat during fair weather so that he or she can acquire the skills to navigate in poor weather without fear or nervous strain.

C.2. Piloting equipment

Piloting in heavy weather can be enough of a challenge without the additional burden of substandard equipment. There are a few items that are absolutely necessary and some listed below, if used, will ease the stress of any piloting evolution.

C.3. Charts

Often the most neglected but critical piece of piloting equipment is the chart. Naturally, an up-to-date chart in good condition is required. The basic principle of heavy weather piloting is based on the assumption that the coxswain must be topside, near the radar, and standing up so that he or she can see all around the vessel and maintain strong lines of communication with the crew. Anyone who has ever tried to lay down a trackline or obtain a fix and plot it while underway knows how awkward it can be. Prepare charts in advance to ease this problem. Using plastic-covered or laminated chartlets makes them easy to correct. Lay down the most common routes that you normally take in your AOR, add some DRs for usual speeds traveled, some radar ranges and distances between fixed

	objects, and you will gain valuable time underway. It is unrealistic to have tracklines laid down for every position in the area but you will have information to get you to a point where you can "jump off" from a preset trackline and pilot to datum. The initial time you will save will enable you to think about the next stage in your response to a distress
C.4. Charts and equipment preparation	The following are some tried and tested methods of chart and equipment preparation, and some common mistakes to avoid.
C.4.a. Personal piloting kit	Take the time to develop your personal piloting kit. Coast Guard standard boats are required to have all the necessary equipment in the chart box as per the type manual, but think of this as backup gear. Build your navigation kit to be user friendly. If space permits, carry duplicates of items that you use most. If your prefer the Weems plotter, carry an extra so that when it slides off the radar shelf and disappears under the coxswain grating, you will have a ready replacement. Any type of carrier that you are comfortable with will suffice. Briefcases, helmet bags, and large container-type clipboards are commonly used.
C.4.b. Chart preparation	Have the right chart for every mission. All too often, coxswains try to cover their entire operating area with one chart. Piloting in the harbor or river with a large-scale coastal chart is inaccurate and unsafe. Prepare your charts in advance with as much information as possible without cluttering it to the point of being illegible. More than likely, the courses from your dock to your entrance are consistently the same. One occasion where this might not be the case is during heavy weather where the entrance breaks and some alternate course might be needed, depending on the direction of the seas and wind. Draw out tracklines from the point of departure to a position where you would normally station keep before crossing the bar or inlet. Along the trackline, lay out some DR positions to aid in determining speed over ground and position. Be realistic about DRs on boats. If you have a three-mile trackline on a constant course with good water on either side, three minute DRs may be excessive and detract from your ability to monitor what is happening around you.
C.4.c. Chart labeling	Label your chart with all pertinent information. The chart should be labeled using common terminology and it should be neat and easily readable. A good rule of thumb is that anyone should be able to pick up your chart and use it to safely pilot the area. Write course directions and

their reciprocals specifying true or magnetic. Distances on all radar ranges and between aids or fixed objects along the track will also help in computing speed. Do not use a red pen or pencil as it will not-show up under a red light. Using a highlighter pen for some information on your chart will help in readily identifying important information.

C.4.d. Radar ranges

One of the most underused methods in piloting is radar ranges. Having a beam radar range at your DR positions take a great deal of the guesswork out of navigation. If you have predetermined ranges laid out, you will be able to see at a glance how far left or right of track you are, well before you reach the DR position. Having these ranges will also allow you to make constant minor changes to your course instead of major changes at each DR position. To simplify matters even more, lay out distances fore and aft as well. Often it is impossible to have a fixed object directly ahead or astern, but even an object 10 to 30° off the bow or stern will give your an approximation of your position up your trackline. These fore and aft ranges are also critical in computing speed over ground using the three-minute rule and its variations. If you are tasked with piloting to datum, lay out ranges from known points of land or from floating aids to navigation to datum. Try to use ranges as close to directly ahead or astern and directly abeam as possible. As you approach the position, it will be easy to determine if you are right or left and too far up or down the track. Then you can adjust your course as necessary.

C.4.e. Chart stowage

Although it may sound trivial, learn to fold your chart properly. Hopefully, you will have taken the time to make chartlets or laminate charts of a workable size with the most common routes and positions already on them. But a chart cannot be prepared for every possible position and it is very likely that you will have to plot a position on a chart, lay out a trackline, and go. If the urgency of the case puts you on a boat heading to sea in heavy weather, take the time to fold your chart so that it is usable. You will be unable to unfold the chart every time you need the distance scale or compass rose. If possible, datum and ranges to datum should be on the same side of the folded chart. Do as much of the chart work as possible before you leave the dock. Everyone has felt the urgency of getting underway immediately, but remember, you are ultimately responsible for the safe navigation of your boat and no level of urgency will be an excuse for running aground or colliding with another vessel.

Equipment Condition

C.5. Straight edge	Although fairly self-explanatory, it is not uncommon to see coxswains using a set of parallel rules with chips along the edge or screws so loose that it moves freely while you attempt to draw a line. The Weems plotter is underused, and if used properly, can be very helpful in getting quick, reasonably accurate ranges and bearings, especially on a folded chart or chartlet.
C.6. Dividers	This drafting instrument is an integral part of a successful piloting job. A "sloppy" pair of dividers is not only difficult to work with, but poses a hazard if it supplies you with inaccurate information There are numerous types of dividers available today that ensure a reasonable amount of friction to hold the legs in place. Specifically, the type that are adjusted with a center wheel are well suited for heavy weather piloting.
C.7. Compass	The compass (or *drawing compass* to distinguish it from the magnetic compass) is much the same as the dividers, but has a pencil lead inserted in one leg and is used for drawing arcs or circles. Always ensure that sharp, spare lead tips are available.
C.8. Nautical slide rule	The nautical slide rule is a quick, efficient tool for determining speed, distance, and time. The tool is accurate and easy to use, but also lends itself to decreasing an coxswain's ability to make mental calculations. A firm grasp of the three-minute rule and its variations is crucial for making quick, hands-off calculations of speed over ground.
C.9. Red lens flashlight	There is no substitute for a user-friendly red light for night operations. It is often difficult to hold a standard "C" or "D" cell flashlight and work additional navigation equipment simultaneously. Smaller lights, some adjustable with beams, have been modified for attachment to clothing and clipboards, freeing navigator's hands.
C.10. Time keeping instruments	It is impossible to pilot a boat without a reliable method of keeping time. There should be two stopwatches on every boat, one in the chart table and one on the navigation receiver. One should always be used as a backup for the other in case they are inadvertently turned off. Remember, you can always compute your speed over ground by backtracking to the time your departed a known point. Always write

down your departure time at a fixed aid or landmark for permanent record. It is prudent seamanship for every member of the boat crew to have a watch.

Specific Techniques

C.11. General

There are some practices that relate strictly to boats in heavy weather. First, a realistic approach must be taken. A boat is not designed to be handled in the same way as a cutter. The size of the crew and the motion of the boat in heavy weather make it very difficult to navigate. If a crew member is not below plotting and relaying information to the coxswain, then the coxswain is either below where he cannot monitor the crew, or he is working the radar and cannot check the plots. The coxswain should brief the crew on the scenario and assign duties. If possible, the coxswain should delegate tasks to other crew members as much as possible. For instance, have your helmsman monitor the depth sounder and give you periodic reports, ensuring that water depth does not drop below a specified amount. Unlike a larger cutter, the boat is a highly maneuverable, shallow-draft vessel that can stop fast and make sharp turns. A common-sense approach using standard navigation practices with the knowledge that the boat never was, is not, and will never be intended to be operated as a cutter will allow you to pilot safely and accurately within the guidelines set forth by higher authority.

Section D. Heavy Weather Person in the Water Recovery

Introduction

Recovering a person from the water in heavy weather requires special precautions beyond the routine described in Chapter 16 on person in the water (PIW) recovery procedures. It may be considered a given that a man overboard/PIW evolution will bring the coxswain and crew to a higher sense of awareness. However, due to the increased risk of operating a boat in heavy weather conditions, special considerations must be given to the level of experience and skill of the boat crew and the capabilities of the boat. It is up to the coxswain, in most cases, to act as he or she sees fit.

NOTE

Do not attempt a rescue in conditions that exceed the operational limitations of the boat and/or experience/skill level of the crew. Use common sense!

In this section

This section contains the following information.

Man Overboard

D.1. General

The general man overboard procedure is put in effect as soon as the alarm is sounded, but the nature of heavy weather adds complications.

D.2. Down swell run

If needed, the turn to run down swell and approach will be planned differently in heavy weather. The coxswain may not be able to turn the boat immediately after the alarm is given. Doing so may expose the bow of the boat to the swell enough that regaining control and getting the bow back into the seas might be very difficult.

The coxswain will push ahead a safe distance from the man overboard and station keep until the opportunity to turn presents itself. The turn is not made until the coxswain can do so without exposing the beam of the boat to the breaks or excessive swells. This is avoided by timing the turn to correspond with the lull in the breaks. Doing so allows the coxswain to take advantage of any window that may develop. Once the window has been identified, the coxswain turns, either port or starboard, using the techniques described in the Heavy Weather Boat Handling section. If the water depth allows, continue down swell past the man overboard. As you pass at a safe distance, make an assessment as to the condition of the man overboard (i.e., conscious and face-up, unconscious and face-down); this will help you decide how best to prepare for your final approach. Also, consider deploying another ring buoy if the first one is out of the man overboard's reach.

D.3. The approach

WARNING

Do not allow any crew to go forward at any time during this evolution. It puts them in great danger and decreases the crew's ability to communicate.

Once the run down swell is completed, the boat must be turned to make the approach. The turn should be made so as to simultaneously put the bow into the surf/swell and have the man overboard directly in front of the boat, keeping in mind the turning radius of the boat and the effect strong winds may have, make adjustments as necessary. This may require some lateral movement down-swell of the man overboard. The pointer must be able to communicate with the coxswain at all times. Positioning the pointer by the coxswain flat/cabin is recommended.

Once down swell, turn quickly and avoid getting caught broadside to the surf/swell. A break taken on the beam may roll the boat.

NOTE

On a CG standard boat, the crew must stay out of the recovery area until the turn is completed, the bow is back into the swell, and the coxswain gives the command.

After completing the turn into the swell or breaks, stop forward momentum and, if practical, station keep by using references on the beach, jetty, and/or adjacent structures. Doing this will give you time to consider the following.

- Your position in relationship to the man overboard.
- Set and drift of both you and the man overboard.
- Wind direction.
- Formation of a window/lull near the man overboard.
- Reestablishing crew responsibilities (if needed).
- Sending a crewman to the man overboard recovery area.

D.4. The Recovery

WARNING

The breaking wave or steep swell can surf a man overboard into the side of the boat or move him astern of it!

When making the final approach, the coxswain must adjust the speed to avoid launching the boat off the back side of a wave. Use the bow bitt or other stationary object on the bow as a sight and aim the boat at the man overboard. Begin slowing to bare steerageway as you near the man overboard. This approach is made so that the man overboard is not in danger of being struck by the boat. Timing is essential! If the coxswain is able, wait for a lull to make the approach.

The crew must keep the coxswain informed of the man overboard's relationship to the boat at all times. This can be done by using reference points on the boat and calling distance off the hull.

D.4.a. Recovery of a conscious man overboard

Ideally, the boat should be stopped with the man overboard at arm's length from the recovery area. This allows the crewman there to simply reach out and pull in the man overboard for recovery. In the event the man overboard is too far away to reach by hand, he or she may be able to swim to or be tossed a rescue heaving line and pulled to the recovery area. Look at all of your options. Keep in mind that a person suffering from hypothermia and/or exhaustion may not be able to assist when being hoisted from the water. Also, using a rescue heaving line in the surf is very risky. The crewman tending the line must remain alert to keep the line under control at all times, and advise the coxswain when the line is in the water.

D.4.b. Recovery of an unconscious man overboard

Recovery of an unconscious victim from the surf presents an even greater challenge. Because the man overboard is unable to swim to or hold on to the rescue heaving line, the coxswain must maneuver the boat so that the man overboard is taken alongside. Again, crew communication is critical. The coxswain steers the boat straight for the man overboard and as he or she begins to disappear under the bow flair, turns slightly to port or starboard (depending on which side is most best for recovery), windward of the man overboard if possible. At this point, the coxswain will lose sight of the man overboard under the bow flair. It is now the pointer's responsibility to inform the coxswain of the location of the man overboard, the distance off the hull, and how far the man overboard is passing down the hull. When the pointer reports the man overboard is approaching the pilot house, the coxswain should begin glancing down at the water, watching for the man overboard to appear. When the man overboard is in sight, the coxswain may need to make a final speed adjustment as necessary. Foam or bubbles passing down the hull can help determine the boat's speed. Having all way off when the man overboard is approaching the recovery area is twofold:

- One, it is very difficult to maintain a handhold on a person when the boat is still moving ahead.
- Second, having to back down with the man overboard near the recovery area is dangerous, and the discharge from backing down may push the man overboard farther away from the boat. Again, slow down well before the man overboard is at the recovery area.

To do this, the coxswain may back down on both engines or on the engine opposite the man overboard. Backing down on the opposite engine will kick the recovery area toward the man overboard. However, do not allow the bow to fall off the swell. Backing down must be done before the man overboard gets to the recovery area so that the boat has no way on during recovery. Also, do not rule out the use of the boat hook if the man overboard is too far away to retrieve by hand. It is better to use a boat hook and recover on the first approach than to back down or run stern to the surf/swell to make another approach. You may only get one chance to make the rescue - Make it good!

Recovery of a PIW

D.5. General

Recovery of a PIW, as in a capsized pleasure craft, is much the same as for a man overboard. However, the coxswain may be required to enter the surf/swell by going lateral to it, backing in to a beach, or running stern to the swell using techniques discussed in the Heavy Weather Boat Handling section. The coxswain will position the boat down swell of the PIW and make the approach as previously discussed.

Use of a Surface Swimmer

D.6. General

Using a surface swimmer in heavy weather or surf is extremely dangerous and should only be used as a last resort. Having a member of the crew enter the water presents other different problems.

- Reducing crew size of an already minimal crew makes it difficult to retrieve the PIW.
- The likelihood of the tending line becoming fouled in the propeller is greatly increased.

Multiple PIWs

D.7. Decision making

For multiple survivors, the questions becomes “which victim is recovered first?” This is a hard question to answer and requires the coxswain’s best judgment. Once on scene, an accurate assessment will dictate the coxswain’s response. Consideration should be given to the following:

- Are one or more survivors injured?
- Which survivors have on PFDs and which do not?
- How close are the survivors to the beach or jetty?
- How old are they and what is their physical condition?

Using the above criteria may aid the coxswain in making this sometimes difficult decision.

Section E. Surf Operations

Introduction

Crews for Coast Guard MLBs and SRBs receive special training for surf operations. The other Coast Guard boats have operating limits that do not allow operations in surf. Safe operation in these conditions requires excellent boat-handling skills, risk assessment, quick reactions, and constant attention from the operator and crew. An understanding of surf behavior and characteristics is also critical. Before entering a surf zone a coxswain must carefully weigh the capabilities of the boat and crew against the desired benefits.

Because of the substantial differences in handling characteristics found in the various types of surf boats, much of the information will be of a general nature. Many basic procedures can be applied to all boats but some techniques are type-specific. Additional guidance on boat type characteristics can be found in the applicable type-manual. The reader must also be aware that every area of operation has it's own distinctive characteristics and some of the techniques described may not be applicable in all cases. A strong understanding of these characteristics and intimate local knowledge are vital for safe operation.

In this section

This section contains the following information:

Risk Management and Safety Considerations

E.1. Surf height and zone characteristics

Maximum operating conditions are set forth in the boat's type manual. Maximum operational and training conditions are set forth in the applicable District SOP. These limits have been established based on the capabilities of the boat and a realistic balance of risk versus benefits, and should not be exceeded.

The characteristics of the surf zone in question must also be carefully considered. Conditions such as very short wavelength, extreme reflection, refraction, shallow water or other factors may make an area too hazardous for operations, even though the surf height is within limits.

E.2. Survival equipment

Any crew operating in the surf must be properly equipped.

- Required hypothermia protective clothing, helmet, boat crew safety belt and signal kit are mandatory.
- Appropriate underclothing, waterproof footwear and gloves should also be worn.
- Goggles may be necessary for visibility, particularly for persons wearing glasses, and will also protect against glass shards should a window be broken.
- Boat crew safety belt must be worn and adjusted correctly.
- Helmet straps must be secured and adjusted properly.

The coxswain is responsible for ensuring that all required equipment is worn, and worn correctly.

E.3. Crew procedures

The crew must be placed where they can use the safety belt padeyes, and where they will be protected from the force of oncoming waves. A large breaker striking the windshield may shatter it, and the crew should not look at the windows if breakage looks possible.

The motions encountered in the surf can be extreme, and crew members must take care to brace properly to reduce body stresses. A shoulder-width stance with the knees flexed will provide the most safety and comfort. Try to anticipate boat motions, and work with the motion of the boat, rather than against it.

E.4. Other factors

In addition to present surf conditions, several other factors will determine whether or not to enter the surf. These include but are not limited to:

- Your boat's seaworthiness, capabilities, and limitations.
- Weather conditions and forecast.
- Depth of water in the surf zone.
- Severity of the case and potential benefits to be derived. Do not allow the urgency of the mission to cause you to hazard your vessel and crew unnecessarily.
- Availability of backup resources.

E.5. Pre-surf checks

Prior to entering the surf a complete round must be made of the boat.

- Stow all equipment, particularly large deck items. Unsecured gear will become a dangerous missile hazard in the surf.
- Make a final check of the engine room and engine parameters, and set watertight integrity.
- Test run the engines at full power.
- Check for proper throttle and reduction gear response in both forward and reverse.
- Check steering for proper effort and full travel, from hard left to hard right and back.
- Ensure all required survival equipment is donned by all crew members.

WARNING

Do not enter the surf if a vital system is not functioning properly. Surf operations require constant attention from both boat and crew, and any deficiencies can lead to mishap.

Forces Affecting Boat Handling in Surf

E.6. Aerated water

Aerated water in the surf zone is caused by breaking waves. As the wave breaks, it combines with air, creating "whitewater" on the face of the breaker. As the breaker moves through the surf zone it leaves a trail of pale or white aerated water behind it which takes some time to dissipate. This air-water mix can create changes in a boat's handling which must be taken into account while maneuvering.

E.6.a. Effect on propeller

A boat's propeller(s) will not create as much thrust when operating in heavily aerated water. The boat's response may be greatly slowed. This effect can be recognized by:

- Poor acceleration and/or apparently slow throttle response.
- Cavitation and/or excessive engine RPM for a given throttle.
- Poor turning performance, particularly on a twin propeller boat.

E.6.b. Effect on rudder

A boat's rudder(s) will not direct the propeller force as effectively in aerated water, nor will it have as much steering effect while moving through aerated water. This effect can be recognized by:

- Poor turning response;
- Reduced steering effort, or "light rudders".

E.7. Shallow water

Operation in very shallow water can be complicated by serious effect on a boat's maneuverability. This effect is caused by resistance to the bow wave as it contacts the bottom, and drag due to the closeness of the bottom to the boat's hull, propellers, and rudders. It can be recognized by:

- Reduced speed over ground.
- Reduced engine RPM for a given throttle position.
- Sluggish response to throttle and steering inputs, leading to poor acceleration and poor turning ability.
- Larger wake then normal.

- Change in trim caused by the bow riding up on its pressure wave, and stern squat caused by propeller suction. This change in trim can lead to grounding of the stern if the water is shallow enough.

NOTE

The effects of operating in aerated or shallow water are similar to the symptoms of serious engine, reduction gear, or steering problems. Any indication of systems trouble must be investigated as soon as possible once safely clear of the surf zone.

E.8. Changes in Center of Gravity and Trim

Changes in center of gravity or trim can lead to dramatic effects on the stability and handling of a boat in the surf. These changes are caused by either external or internal forces, and can vary widely depending on condition, type of boat, and other factors.

E.9. External forces

The primary external force for surf operations is the surf itself. A boat's position, speed and heading relative to a wave will dictate the effects on stability and handling. These effects are numerous and will not be covered entirely, but a description of the most significant effects is provided.

E.9.a. Running stern-to

As an approaching wave reaches the stern, the stern will rise and the center of gravity and the pivot point are shifted forward. As this process develops, the trim of the boat changes and may reach a point where the propellers and rudders are no longer deep enough to be effective. This can cause a severe reduction in maneuverability or complete loss of control, as the stern picks up and falls to either side in a broach.

This effect is most common on very steep swells or breakers, and can be greatly amplified if the operator reduces power, which causes an even greater shift in the center of gravity.

E.9.b. Broaching, or running beam-to

As the approaching wave reaches the boat, it will cause it to heel over and shift the center of gravity to the low side of the boat. This may lead to a reduction in effectiveness of the propeller and rudder on the high side, which will cause reduced maneuverability.

E.9.c. Bow into seas

As the approaching wave picks up the bow, the center of gravity and pivot point will shift aft. If the boat does not have enough way on, and the bow is not sufficiently square to the wave, it may cause the bow to fall to one side or the other as the force of the wave pushes it around the new pivot point.

E.10. Internal forces	There are numerous internal forces that affect the stability and handling of a boat, many of which are permanent aspects of the boat's design. It is the responsibility of the operator to be familiar with the characteristics of the specific boat in question. The following is a description of those factors which are subject to change, or under the direct control of the operator.
E.10.a. Free surface effect	The shifting of fuel or water inside a boat can have a great effect on stability and handling.
E.10.b. Unsecured or improperly stowed equipment	Loose equipment can be tossed to one side and affect stability by placing weight off center.
E.10.c. Changes in throttle or helm input	Generally, a rapid reduction in power will result in a forward shift of the center of gravity, while an increase will have the opposite effect. Large steering inputs will cause a boat to heel over, shifting the center to the low side.
E.11. Rollover causes	Rollovers have occurred in a wide variety of situations, and each rollover is somewhat unique. A rollover or knockdown (near roll) is never routine. A roll will generally occur when a boat is placed beam-to or broaches in a breaker the same height as the beam of the boat. The operator's actions at this point can determine whether or not the boat is spared. Some rollovers have occurred in smaller conditions, and cases of open ocean rolls have been documented. The steepness of the wave has an effect as well as the height. Any situation which places the center of gravity over the center of buoyancy can result in a roll. A surf boat operator must be constantly aware of the conditions and take action to avoid being caught beam-to or broaching. A rollover is to be avoided at all costs.

E.12. Pitchpole or bow-on causes

A pitchpole or bow-on is when a boat is inverted end-over-end. This can occur when a boat is traveling stern-to a very steep breaker or large wave. As the stern is picked up, the boat begins to surf down the face and the center of gravity shifts forward. If the stern rises high enough, the bow will begin to dig deeply into the trough of the wave, and the resistance created will cause the boat to trip over itself, tumbling end-over-end. A reverse pitchpole is also possible if a boat is surfed backwards while bow-to a large breaker.

Pitchpoles are rare, but are possible, particularly for a relatively small boat. More often, an impending pitchpole will turn into a broach and rollover. The operator must avoid situations which could lead to a pitchpole since they are violently destructive to the boat and its crew.

Basic Surf Operations

E.13. General

The scope of this Addendum does not allow a detailed discussion of boat type-specific handling characteristics or techniques, but general techniques and procedures can be covered. Because of various local conditions and requirements, there is absolutely no substitute for underway training. Frequent formal training should be conducted by certified personnel in a variety of surf conditions in the local area. Operators should be allowed to acquired the experience necessary to read the waves and get a solid feel for the capabilities and limitations of their boat. Published training limits should not be exceeded for good reason. The majority of surf mishaps have occurred during training rather than actual operations.

E.14. Constant action

Operations in surf or heavy seas requires constant action by the operator Waves can travel at up to 35 knots, and few boats can outrun a fast wave, or maintain a position on its backside.

WARNING

Never allow the boat to be caught below a breaking wave. Either allow it to break before it reaches you , or get to the top before it falls on you. One cubic yard of seawater weighs almost a ton. A 20-foot breaker can drop 1,500 tons of water on the boat, and exert a force of up to 6000 PSI.

Maintaining a 360 degree watch for approaching waves is critical. The surf zone is a constantly changing, dynamic environment, and the fifth or sixth wave back is often as important as the one that you are immediately faced with. Crew members must be alert and familiar with surf characteristics, and a constant high level of communication is vital. The operator must concentrate on positioning the boat to avoid being caught under a breaker, or taking it at the wrong angle. Maneuvering to avoid the breaks is preferable, but if one can not be avoided, it should be taken bow-on, if possible.

E.15. Techniques

The following description of techniques has been organized to follow the sequences of an actual operational situation, such as entering a beach surf zone to recover persons in the water, or crossing a bar or inlet.

E.16. Entering a beach zone or inbound transit of bar/inlet with surf on stern

General steps are outlined below.

E.16.a. Preparations

Step	Procedure
1	Advise station and backup resources of intentions.
2	Acquire bar/inlet or surf zone conditions from all available sources, such as beach/tower personnel or other vessels in the vicinity. It is very difficult to evaluate actual conditions from seaward.
3	Brief the crew and assign duties.
4	Conduct a full pre-surf check of engine room and engine parameters. Check the entire boat for secure stowage. Set watertight integrity, and check boat crew protective clothing.
5	Test engine and steering system controls.
6	Identify any useful natural ranges and landmarks.
7	Identify safe operating areas and hazards. Evaluate surf conditions and possible safer routes, such as bar/reef openings or rip channels.
8	Stand off and observe wave trains. Attempt to identify any patterns such as lulls or series that may be present.

E.16.b. Execution

It is preferable to transit the surf during any lull period that may exist. Wait until the last big wave in a series has passed and proceed in closely behind it, at maximum comfortable speed. This reduces the relative speed at which the waves approach, and gives the operator more time to react, as well as getting you through the zone as quickly as possible. It may also provide the best maneuverability for some boats. The operator should attempt to work through the surf zone by driving through windows and wave saddles, thus avoiding the majority of the breakers. Some boats may be fast enough to avoid breakers by maintaining position in a trough or on the backside of a swell while others will eventually be overtaken by every wave as it approaches.

WARNING

Reducing speed after the wave has already picked up the boat will likely result in a loss of control and/or broach. Speed must be reduced before the wave arrives.

If operating in an area of limiting maneuverability, such as a narrow inlet or bar, the operator may have to rely strictly on timing the waves and make the transit during lull periods. Also, if there is no discernible lull, it may be prudent to wait at sea until conditions improve.

To deal with an overtaking breaker or peaking swell there are a number of techniques, which vary in success and safety based on conditions and type of boat. An operator must understand the effectiveness and safety of a technique for the specific boat, which is gained from training experience.

WARNING

"Backing through" a breaker is an advanced emergency procedure which can easily result in personnel injuries or boat damage. It is a last resort maneuver for experienced operators.

These techniques are listed in descending order of preference and safety:

1. Maneuver left or right (lateral) to avoid the breaker completely, by using windows and saddles.
2. Come about in sufficient time to meet the breaker bow-on.
3. Reduce speed before a steep, peaking (not breaking) swell reaches the boat, allowing the swell to pass and break ahead of you, and then immediately increase speed to follow it in.
4. As a wave approaches, begin backing square into it. You should gain sternway and climb the wave before it breaks. Never allow the boat to be caught under a breaker. If it is necessary to back through the whitewater of a breaker, you must gain sternway before the whitewater reaches the propellers and rudders. Move smoothly into the wave as it lifts the stern, using only enough power to maintain sternway. The momentum of the boat will break it through the wave. Once the stern breaks through, ease off the throttles and prepare to resume your course ahead.

5. If you are overtaken by the white water of a breaker, your last resort is to try to get off the wave by applying full throttle, and steering for the "low side" of the wave, hopefully coming out the backside. Do not attempt to ride it out by maintaining course. You must do something. Never forget to drive the boat.
6. A final option may be to back into the surf zone or across the bar, keeping the bow into the seas. This will be very difficult and time consuming. Excellent backing skills are mandatory. Strong opposing currents in the area may make backing impractical. Also, great care must be taken in shallow water, as the propellers and rudders will hit first if the boat strikes bottom.

E.17. Transiting with surf on beam (lateral transit of surf zone)

General steps are outlined below.

E.17.a. Preparations

Step	Procedure
1	Brief crew and assign duties.
2	Identify safe operating areas and hazards. Evaluate surf conditions and possible safer routes, such as longshore channels where the surf may be smaller.
3	Advise station and backup resources.

E.17.b. Execution

It is preferable to make a beam transit during a lull, when the seas may be smaller. Wait for the last big series of waves to pass and commence the run. In the absence of lulls, great care and patience must be exercised , because you will be dealing with nearly constant beam surf, and the boat is very vulnerable in this position. The operator should use maximum comfortable speed to minimize exposure to beam seas. Speed may be reduced to allow waves to pass ahead of the boat, or increased to avoid a breaker. Good timing, and ability to read several waves back are critical. Any significant waves which cannot be avoided must be taken bow-on.

WARNING

Do not get surprised by a breaker on the beam while watching the one ahead, as there is a good chance of a rollover if you are hit on the beam at slow speed.

There are several techniques to deal with breaking seas on the beam. The suitability of a technique is dependent on the boat type and present conditions. The operator must have an understanding of the boat's capabilities, as some maneuvers may not be safe or effective in all cases. The following techniques are listed in descending order of preference and safety:

1. When it is apparent that the boat is about to be overtaken by a breaker, retain or increase speed and turn to meet it square with the bow. Once square to the wave, the helm must then be returned to amidships and throttles decreased to avoid launching through the crest. Station keep if necessary, and prepare to return to original course.
2. If a breaker is approaching from ahead of the boat, decrease speed to allow it to pass ahead. Time the maneuver to reach the back shoulder of the wave just as it passes in front. This timing will allow you to quickly get behind the wave and continue the transit, and hopefully avoid the next wave altogether. The crew must be alert for other waves building off the beam.
3. If a wave is some distance off the beam, you may be able to outrun it by increasing speed. If there is any chance that you will not beat the wave, you must turn to meet it or run away from it if space and time permit.
4. In some instances, there may be time and room available to find a window by running away from a breaker, placing it on the stern or quarter. This carries all the risks associated with running stern-to, and will also set you off the original track line or range, as well as being time consuming. It is not the most efficient means of transiting, but may be a valuable safety maneuver depending on the circumstances.
5. When transiting very small surf relative to the size of the boat, it may be possible to maintain or slightly reduce speed and simply turn towards a small breaker at about a 45 degree angle, resuming course behind it after crossing the crest. **WARNING**: This maneuver is only safe in small conditions and must not be attempted if the operator has any doubts. Wave avoidance is still the preferred technique.

E.18. Station keeping (bow into surf)

Station keeping is maintaining a given position in the surf. Station keeping is necessary to hold position while waiting for a window or lull, or holding position prior to and during recovery of a person in the water. Environmental factors such as the surf, wind, or currents can make station keeping difficult, and good backing skill and proper application of power are essential. The following are guidelines for station keeping:

- Use only enough power to maintain position and counteract the force of the oncoming wave. On smaller waves, keeping the bow square with neutral throttles may be all that is needed, while larger waves my require a great deal of power to counteract. Using too much power will set you out of position and/or launch the boat. Too little power will cause you to be set backwards, or broach the boat.
- Keep the bow as square to the seas as possible.
- If you are being set towards the seas by current or wind; it may be necessary to back down frequently to hold position, only applying forward power to meet oncoming waves. Wait until a wave crest passes and back down once on the backside. Do not back down on the face of a wave.
- By adjusting power, it may be possible to safely allow a wave to set you back to regain position. This technique requires practice, and the operator must maintain control of the maneuver at all times.
- It is possible to move laterally while station keeping by allowing the bow to fall slightly to the desired side and then using the throttles and helm to straighten out as the wave pushes the bow.

  For example, to crab sideways to port, allow the bow to fall slightly to port and as the wave pushes the bow, apply power and steer to starboard, finishing the maneuver with the bow once again square to the seas. This maneuver must not be attempted on large waves, and it is important not to allow the bow to fall off so far that the safety and control of the boat are compromised.

E.19. Outbound transit of bar/inlet or surf zone (bow into surf)

An outbound transit of the surf may be necessary in crossing a bar/inlet or departing a surf zone. The operator should practice wave avoidance by picking a course through the windows and saddles, if available, minimizing risk to the boat and crew. The transit should be made at maximum comfortable speed, adjusting to avoid launching over the waves, or avoiding them entirely. The following guidelines apply to an outbound transit:

WARNING

Do not allow a wave to break over the boat while transiting outbound. If it appears that this may happen, you must either reach the top before it breaks, or slow down/stop, letting it break in front of you and then regaining headway in time to meet the whitewater.

- Choose a course through windows as much as possible, zigzagging as necessary to avoid breakers. Stay close to the shoulders of the waves, to take advantage of any window which may open up behind the wave as it passes.
- If a breaker cannot be avoided, try to go through the wave at the saddle, where it may not be breaking yet, or the force may be less. If both ends of the wave are breaking towards the saddle, you may be caught in a closeout. Get through the saddle before it closes, or slow down to let it closeout well in front of you.
- Any breakers that cannot be avoided should be taken bow-on. Slow down and allow your momentum to carry you through. Do not meet breakers at high speed or you may plow into the face, or launch off the back, risking injuries or boat damage.

E.20. Emergency Procedures: Rollover or involuntary beaching

A rollover or beaching is never routine, but always possible. These unpleasant events must be considered and planned for. Training and experience will give you the edge, but it can still happen to you simply because of the severe environment you are operating in. The following risk management practices should be followed:

- All crew members must be properly outfitted, and equipment properly worn.
- All surf boat crew members should be familiar with the causes of rollover and pitchpoling, as well as how to recognize an impending event, and what to expect.

- All crew members should be well trained in procedure to be followed for rollover and involuntary beaching. Crew members must be familiar with procedures for emergency anchoring and drogue deployment as well as the location of necessary equipment. If possible, the crew should be briefed on these procedures prior to entering a surf zone.
- Crew members should be capable of taking control of the boat should the operator be lost overboard, in order to prevent further rolls. The ability to recover the operator is also highly desirable.
- A backup surf capable resource or aircraft should be standing by whenever possible, positioned where it can observe the boat working in the surf.
- Backup communications (handheld VHF) should be aboard the boat in case the antennas are lost, or main radio damaged.
- Always assess the risks you take versus the potential benefits. Do not let a sense of urgency cloud your judgment or get you into a losing situation.

E.18.a. Procedures

WARNING

Do not unfasten your safety belt or consider swimming to the surface. It is likely that the propellers will still be turning, and the boat is designed to right itself in a few seconds.

Step	Procedure
1	A rollover is usually the result of a severe broach. If your lower gunwale is under water, be prepared to roll. Experience and familiarity with the boat's normal motions may warn you of an abnormal situation.
2	If time allows, advise the crew to hold their breath. Hold on firmly to whatever you can. While upside down, you will be completely disoriented and unable to see. You may hear the engines.
3	Immediately upon re-righting, assess the situation, as you are still in the surf and must take quick action to meet the next wave correctly or you may roll again.
4	Check the crew to ensure that no one was lost overboard or seriously injured.
5	Check the deck and surrounding water for lines or equipment which could disable the boat.
6	If the engines are still working, move to safe water.

7	Once in safe water, the engineer should go below to check for damage. Secure non-vital electrical circuits. The engine room may be coated with water and oil, presenting a fire hazard. If there is no fire, the engineer should dewater the engine room, and check the oil in the engine(s).
8	Check the condition of the boat. Fuel may have spilled from the exterior vents, covering the weatherdeck and crew. The superstructure may be damaged, windows may be broken, and large fixtures such as the mast, anchor, pump can, towline reel, or helm chair may be damaged or missing. Installed electronics will likely be inoperative.

E.18.b. Continuing or returning

After damage and injuries have been assessed, you must determine whether to continue with the mission or return to the unit. The following factors should be considered:

- Condition of crew members
- Overall material and operating condition of engines and boat structure
- Condition of electronics, particularly communications.
- Urgency of mission, and availability of backup resources.

Upon returning to the station, post-rollover procedures must be taken in accordance with the boat's type manual.

E.18.c. Procedures for involuntary beaching

If your boat is disabled in or near the surf, it will be driven into the shore. Notify the station or backup resource immediately. The chances of rollover or crew injuries can be reduced by taking these actions:

WARNING

Do not expose crew members to the likelihood of serious injury or loss overboard by sending them to the bow in heavy surf. It may be safer to sustain a roll while waiting for a lull. This is a judgment call.

Step	Procedure
1	Try to set the anchor with as much scope as possible. If more line is needed, bend the towline to the anchor line.
2	If unable to anchor, attempt to set a drogue astern. This will minimize the chance of rolling, and hopefully cause the boat to beach bow first.
3	All crew should go below and secure the hatches . Strap yourselves in with the seat belts.

4	Stay with the boat and ride it out. You may capsize several times on your trip to the beach.
5	Once the boat is beached, stay put. The waves push the boat farther up the beach. Do not be in a hurry to leave the boat.